

# Suit Sizing

## New space suits can be sized in space saving storage, deliveries

By Karen Schmidt

The STS-79 mission will carry into orbit a new space walking suit designed to fit more than one astronaut and save storage space, bringing tomorrow's International Space Station technology into today's missions.

Extravehicular Activity space suits are the astronauts' life blood when they must work outside the protected environment of a space shuttle. Equipped with life support, an astronaut can spend up to seven hours performing maintenance tasks in the shuttle's cargo bay or on the future space station. With EVA tasks expected to increase during station assembly and operation, JSC, in cooperation with Hamilton Standard, ILC Dover, Air-Lock and Boeing Aerospace Operations, is revamping space suits to save storage space, meet weight limits and reduce the amount of equipment required on flights to the station.

One of the first phases of the redesign was to develop a way to resize a suit faster on the ground and in orbit. Currently, ground technicians change suit sizes by lacing in different lengths of fabric inserts. "In order to make a suit fit an astronaut, technicians must change the inserts in the arms and legs of a suit," said Ralph Anderson of the Flight Crew Equipment Management Office. "It is a long and cumbersome process that takes about 16 hours to prepare a suit for a particular astronaut." Astronauts also are trained to change-out inserts in the suits, but the process is slow and tedious, taking up valuable on-orbit time. The new design features sizing rings in both arms and legs that can be changed out in less time.

"With the enhanced sizing rings, a suit technician can change the size of a suit in

less than 20 minutes," Anderson added. Not only can suit technicians change the size of an EVA suit, the astronauts on orbit will have the same capability. "That's the whole idea, multiple crew members can use the same suit for space walks on the International Space Station," Anderson said.



The new rings, made of aluminum, are available in 1/2 size at the arm and thigh and three different sizes for the lower leg—1/2, 1 and 1 1/2 inch. There also are four different sizes of leg segments and eight sizes of lower arm segments that the astronauts can choose from. One leg attachment that fits from thigh to ankle can be sized up to three inches—with so many combinations, a single suit can be sized to fit a number of astronauts.

"We will be able to carry a couple of suits and leave them on the space station with enough sizing components to fit different astronauts, thereby eliminating the need to carry suits for specific astronauts on every flight," said Rodney Johnson, lead for the Training Extravehicular Mobility Unit Laboratory at Boeing.

The design of the sizing rings evolved from rings used on an advance development suit. The major difference is that the new rings are threaded and twist on. Each ring has two automatic spring locks and one manual lock.

"The new ring uses a pressure seal that is an adaptation of the static seal that we have been using for a decade and a half in disconnects found at the neck, gloves and



waist," said Don Lacey of ILC Dover. "Adapting proven designs reduced our learning curve tremendously. The suit was designed to meet the space station mission, but we will begin to reap the benefits of this new suit right away." In addition to the new rings, Adjustable Restraint Brackets also are being used for the first time. They allow astronauts to lengthen or shorten the arm and leg segments in smaller increments than the rings. "You can lengthen either end up to one half inch," said Scott Cupples of ILC Dover, "giving an astronaut a custom fit."

The suits will fly for the first time on STS-79, but the big test will be on STS-82 when they will be used during scheduled space walks to service the Hubble Space Telescope. Because the position of the airlock on *Discovery* during STS-82 effects its center of gravity, mission managers asked if only three suits could be flown for the four space walking astronauts.

Mission Operations STS-82 EMU Lead Paul Boehm and back-up Dana Weigel were able to answer 'yes' because of the new sizing capabilities. Mission Specialists Joe Tanner and Steve Smith will share one suit, bringing enough sizing rings and leg attachments to custom fit the two space walkers.

"We are relying on these rings to accomplish a resize in a much shorter time," Boehm said. "It is going to be nice to have

the capability to do this on orbit, it gives us a lot more flexibility and helps us focus on the primary objectives of the mission." "The sizing rings add a new, much needed capability to resize the EVA suits in flight," Tanner said. "This capability



allows us to carry only three suits to accommodate four EVA crew members. The rings are very easy to use, requiring only a few minutes to change arm and or leg segments to fit another crew member. The rings don't restrict your motion in the suit in any way, in fact, I can't even tell they are there. Other modifications that go along with the enhanced EMU allow crew members to make minor adjustments to arm and leg segment lengths that could previously only be made by a ground technician. The end result is a better suit with more capability and flexibility to carry

us into the station era." More redesigns are in the works. The Hard Upper Torso, or HUT, will be fitted with new quick disconnects instead of bolt on attachments that connect the Primary Life Support System. These quick disconnects are expected to work better and faster and the pivot points at the shoulders of the current HUT will be deleted to give the astronauts better mobility and make the suit more robust. The new designed HUT also will remove four possible failure points that now exist in the older model.

"If we had a space station today, this suit would be ready to fly," said Tony Wagner, spacesuit subsystem manager in the Crew and Thermal System EMU Group. "We could leave it on the station for many space walks before it would have to return for maintenance. It is certified and ready to go for EVA." □



From top to bottom, left to right: 1) From left, Rodney Johnson, lead for the Training Extravehicular Mobility Unit Laboratory at Boeing Aerospace Operations, demonstrates how the new enhanced sizing rings work to NASA Deputy Administrator John Dailey and JSC Director George Abbey. 2) The new rings replace fabric sizing inserts that were hand laced into the suit by technicians, taking up to 16 hours to resize one suit. 3) Another new design feature is an

Adjustable Restraint Bracket that gives astronauts a second length adjustment feature in the arms and legs of a space suit. 4) Leg rings come in three different sizes assuring a custom fit for the astronauts. 5) From left, Robert Nicholson and Ron Lindsey prepare a suit in the flight EMU laboratory for STS-79. 6) From left, Latonya Hagler and Nicholas Barnett check an arm ring assembly.

Photo by Mark Sowa